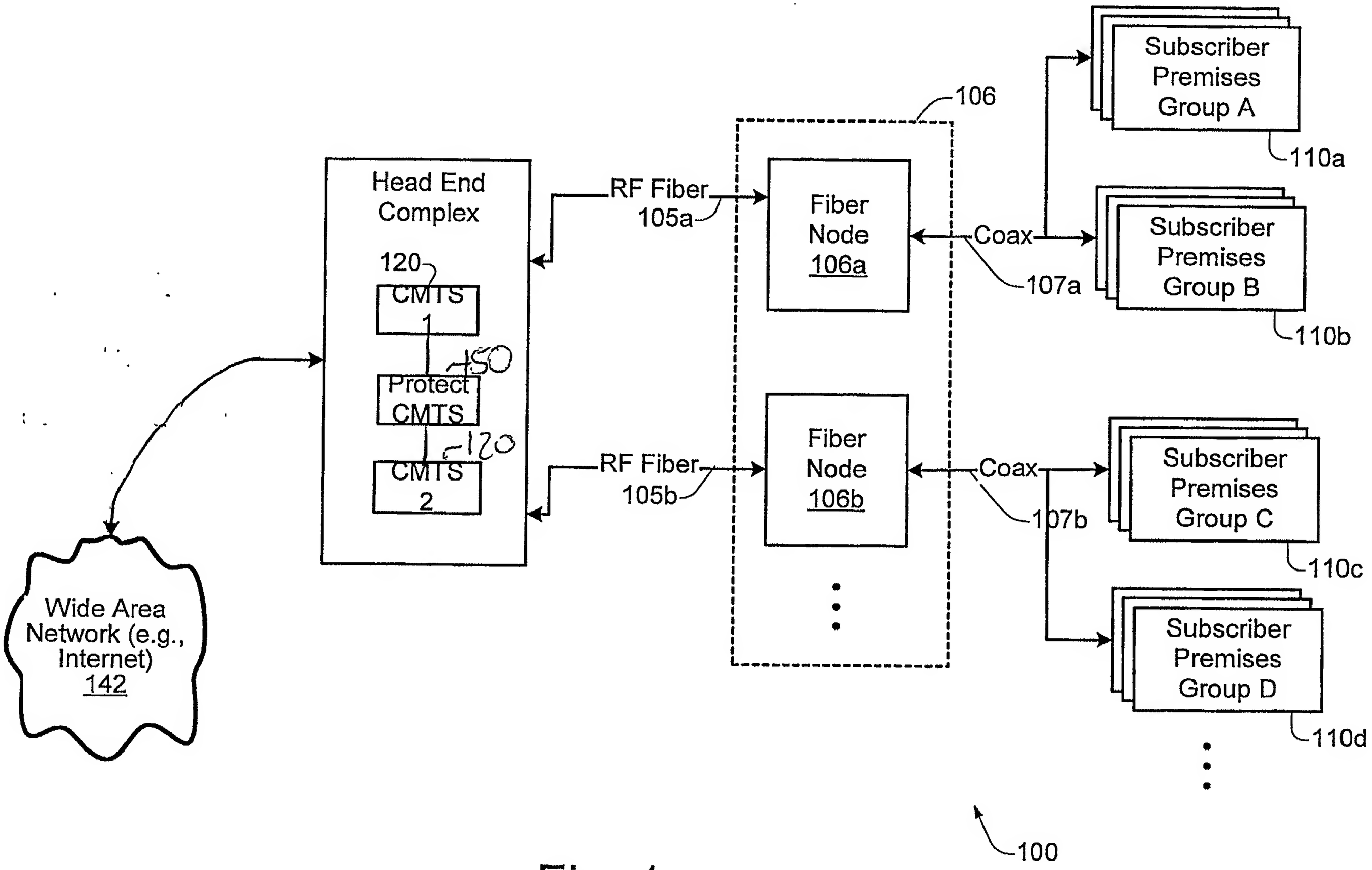
Head End Complex
120
CMTS 1
150
Protect CMTS
120
CMTS 2
RF Fiber 105a
RF Fiber 105b
106
Fiber Node 106a
Fiber Node 106b
Coax
107a
107b
Subscriber Premises Group A
110a
Subscriber Premises Group B
110b
Subscriber Premises Group C
110c
Subscriber Premises Group D
110d
Wide Area Network (e.g., Internet) 142
100

Fig. 1

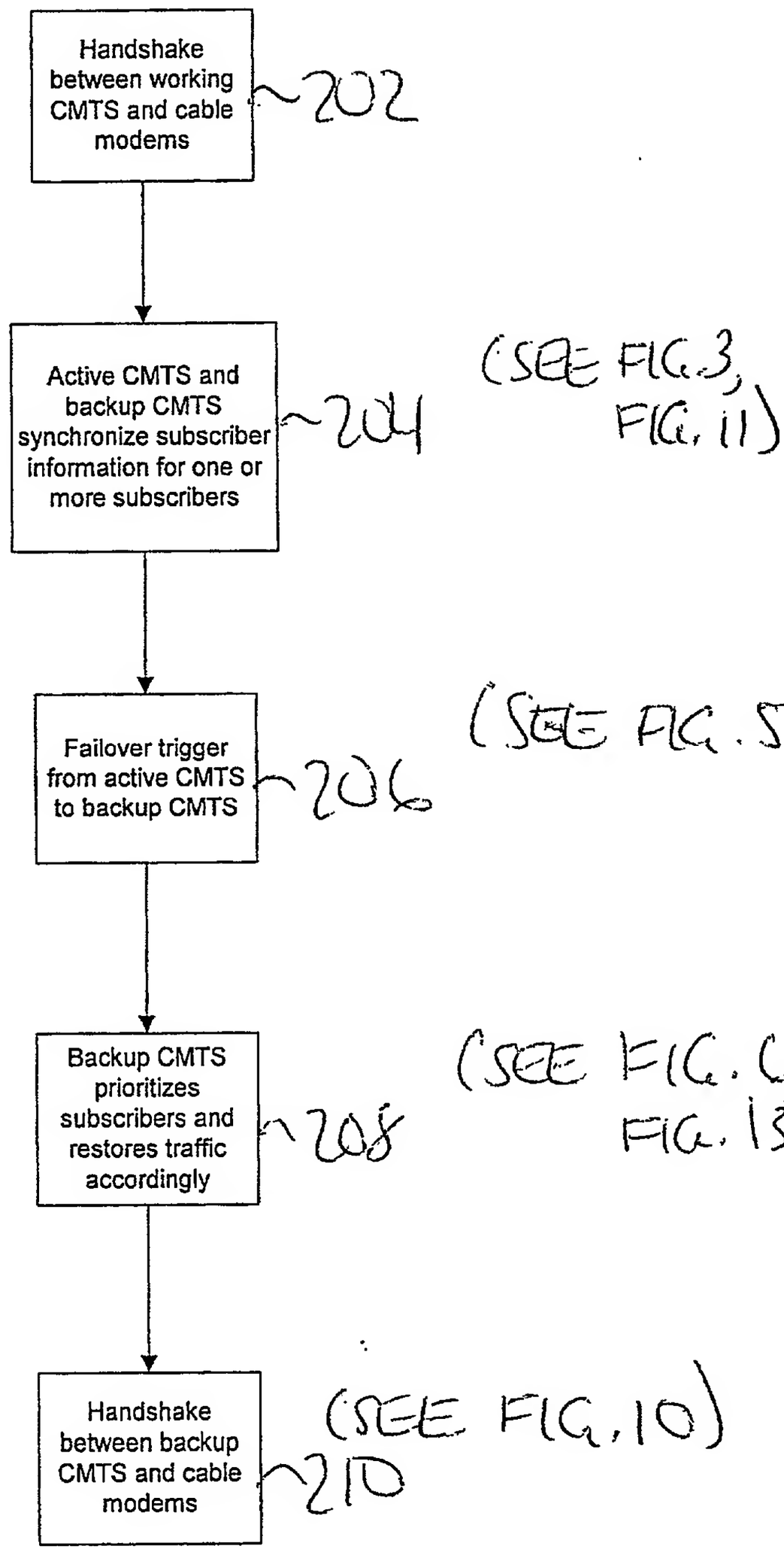
Handshake between working CMTS and cable modems
202
Active CMTS and backup CMTS synchronize subscriber information for one or more subscribers
204
(SEE FIG. 3, FIG. 11)
Failover trigger from active CMTS to backup CMTS
206
(SEE FIG. 5)
Backup CMTS prioritizes subscribers and restores traffic accordingly
208
(SEE FIG. 6, FIG. 13)
Handshake between backup CMTS and cable modems
210
(SEE FIG. 10)

FIG. 2

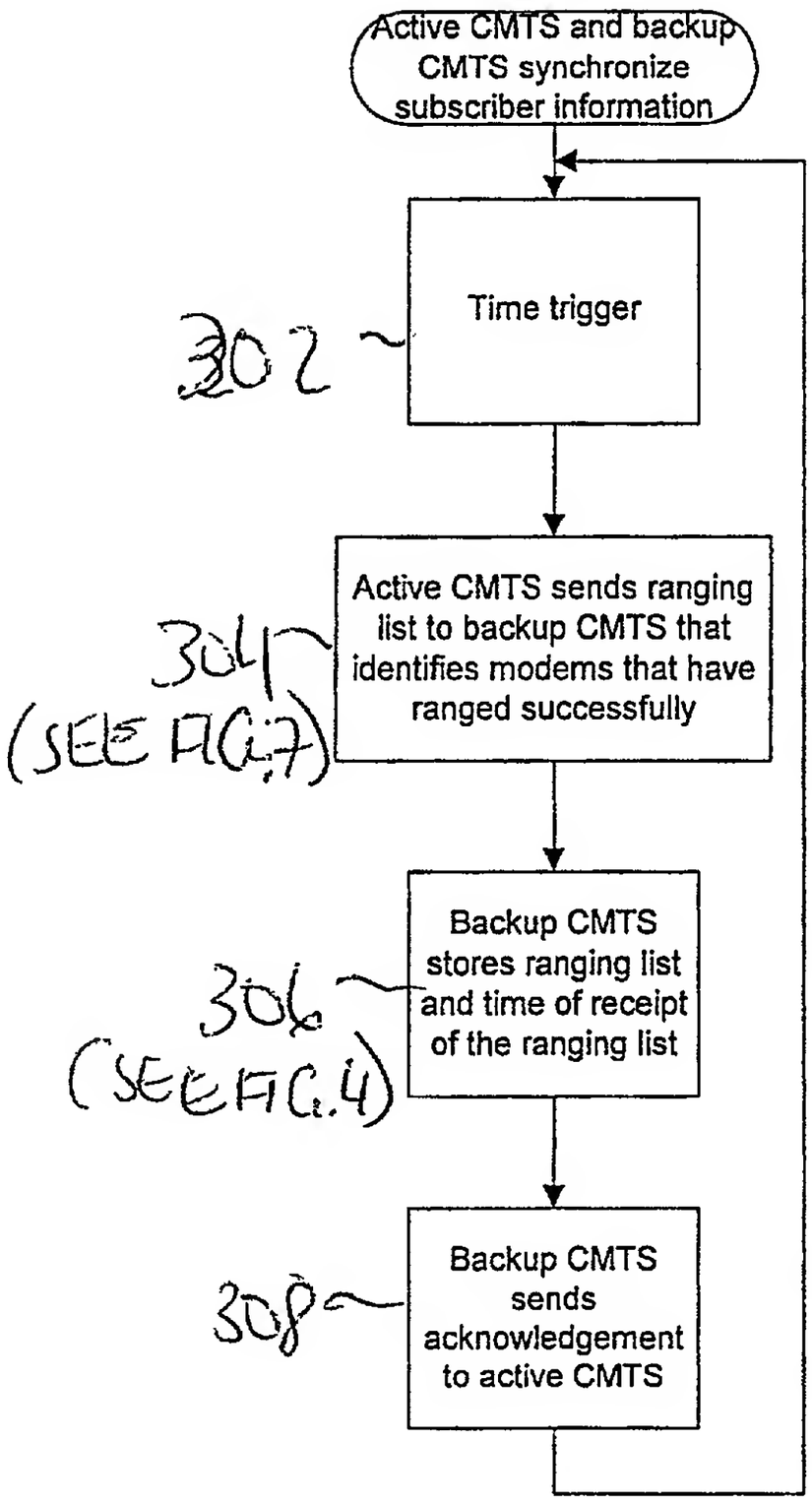
Active CMTS and backup CMTS synchronize subscriber information
Time trigger
Active CMTS sends ranging list to backup CMTS that identifies modems that have ranged successfully
Backup CMTS stores ranging list and time of receipt of the ranging list
Backup CMTS sends acknowledgement to active CMTS
204
302
304
(SEE FIG. 7)
306
(SEE FIG. 4)
308

FIG. 3

Modem ID	MAC address
ID1	MAC1
ID2	MAC2
.	.
.	.
IDN	MACN
Time of arrival t1	

404 406 402 408

Modem ID	MAC address
ID1	MAC1
ID2	MAC2
.	.
.	.
IDN	MACN
Time of arrival t2	

412 414 410 416

FIG. 4

Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number.

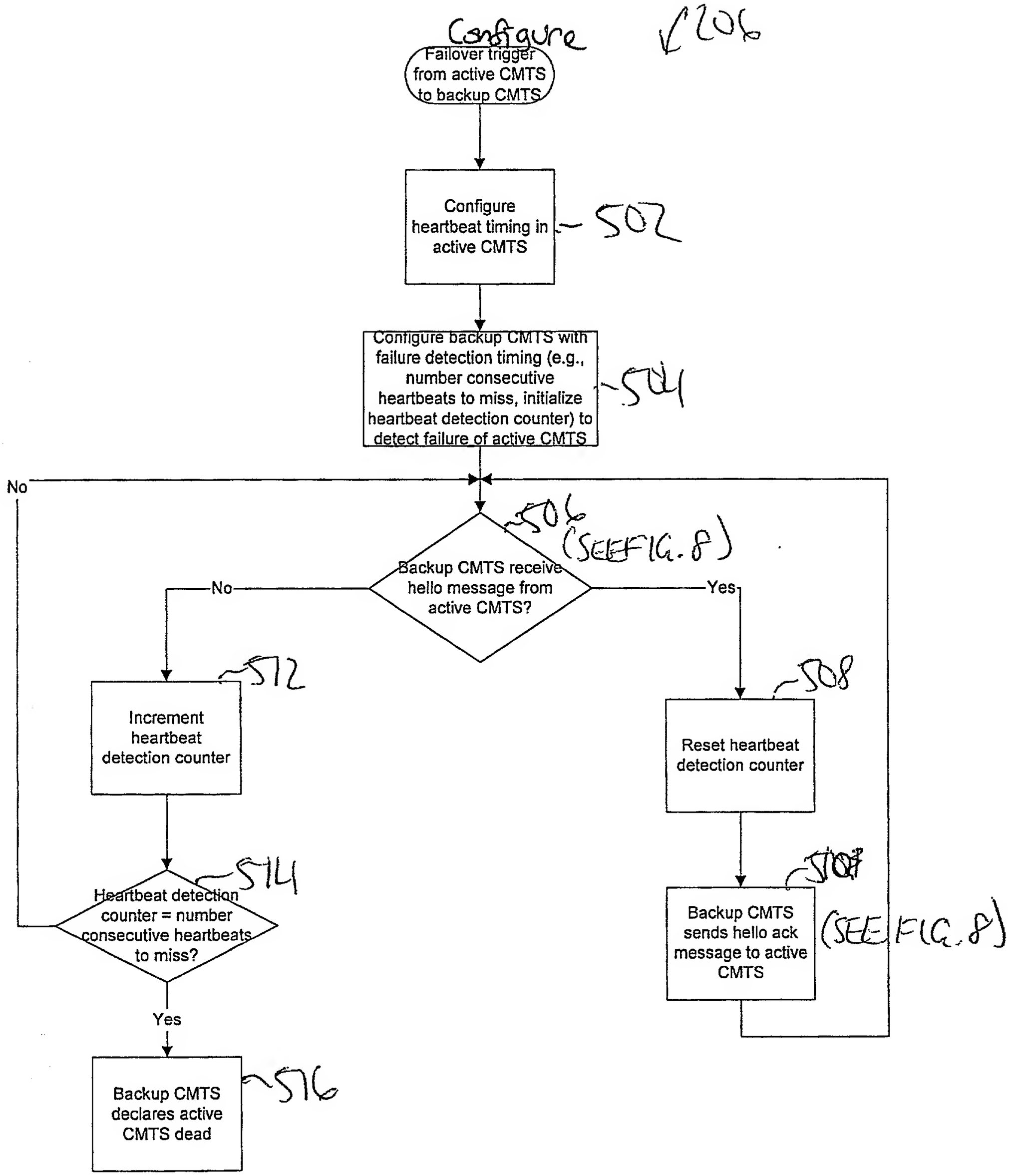
Configure
206
Failover trigger from active CMTS to backup CMTS
Configure heartbeat timing in active CMTS
502
Configure backup CMTS with failure detection timing (e.g., number consecutive heartbeats to miss, initialize heartbeat detection counter) to detect failure of active CMTS
504
No
Backup CMTS receive hello message from active CMTS?
506
(SEE FIG. 8)
No
Yes
Increment heartbeat detection counter
512
Reset heartbeat detection counter
508
Heartbeat detection counter = number consecutive heartbeats to miss?
514
Backup CMTS sends hello ack message to active CMTS
510
(SEE FIG. 8)
Yes
Backup CMTS declares active CMTS dead
516

FIG. 5

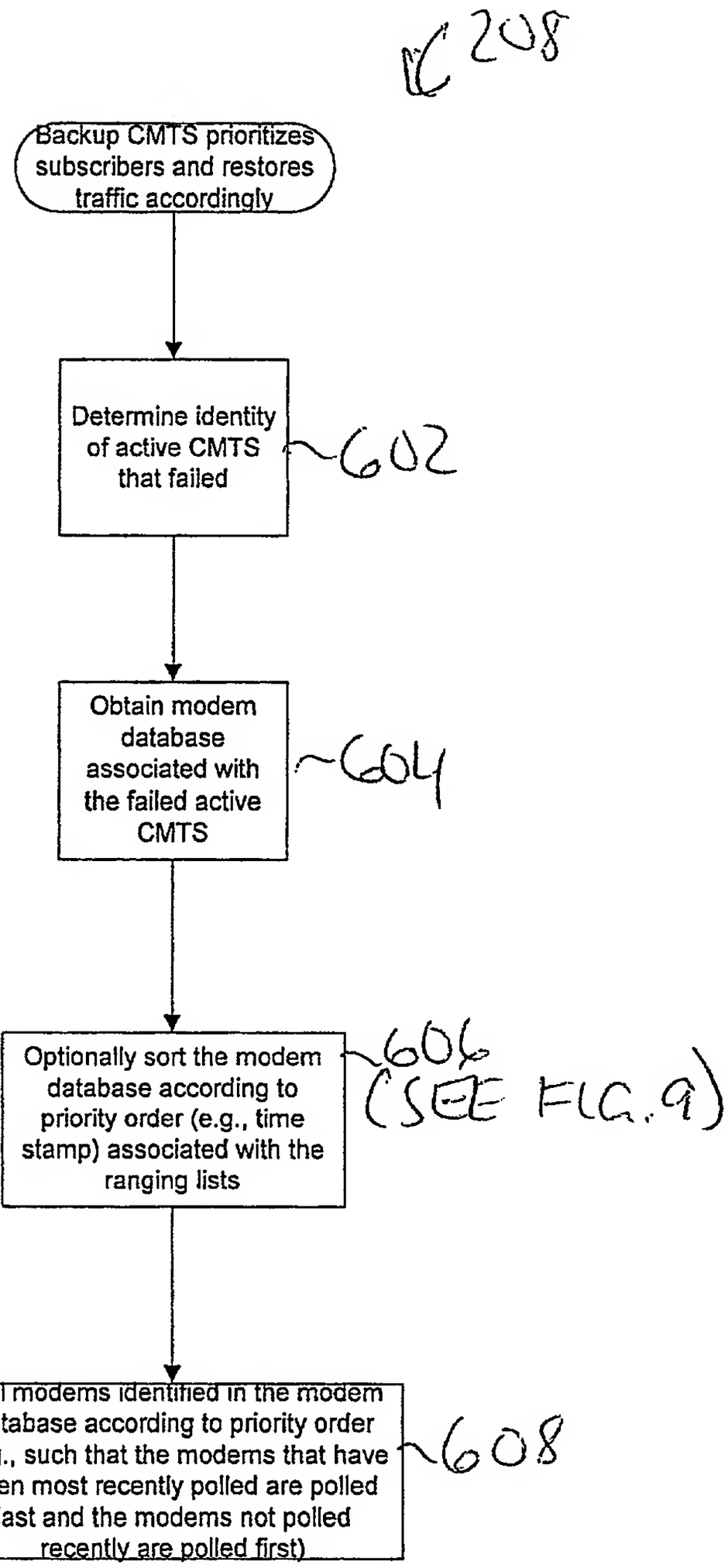
208
Backup CMTS prioritizes subscribers and restores traffic accordingly
Determine identity of active CMTS that failed
602
Obtain modem database associated with the failed active CMTS
604
Optionally sort the modem database according to priority order (e.g., time stamp) associated with the ranging lists
606
(SEE FIG. 9)
Poll modems identified in the modem database according to priority order (e.g., such that the modems that have been most recently polled are polled last and the modems not polled recently are polled first)
608

FIG. 6

700

702	704	706	708		
Header	T	L (e.g., 3)	SID1	SID2	SID3

FIG. 7

800

802	804	806	808
Header	T	L	V = Hello/hello ack

FIG. 8

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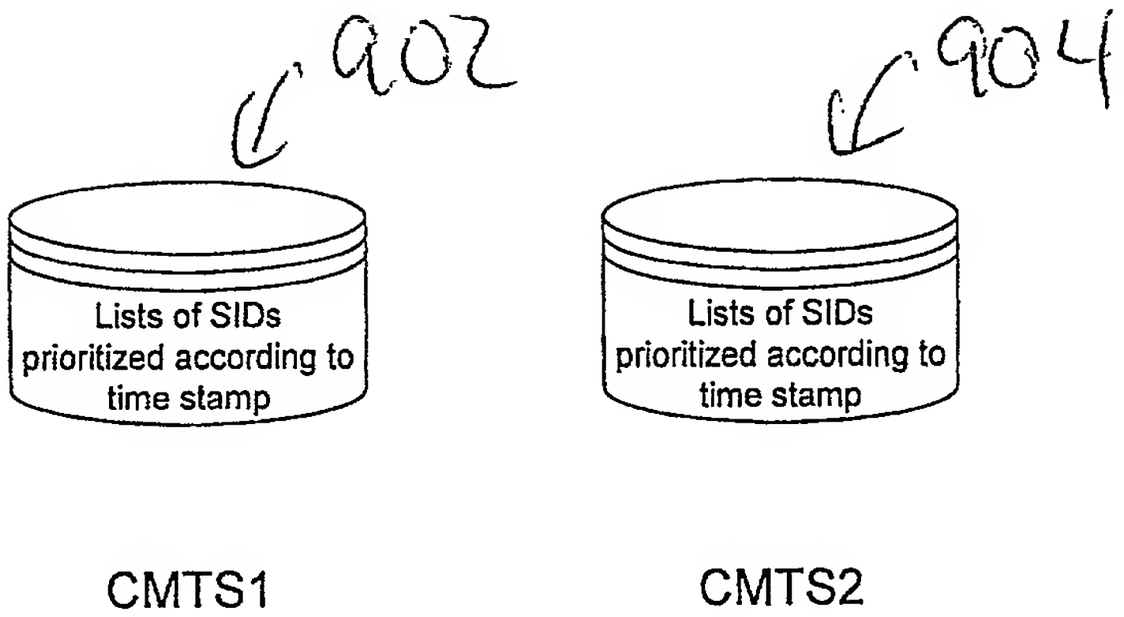

FIG. 9

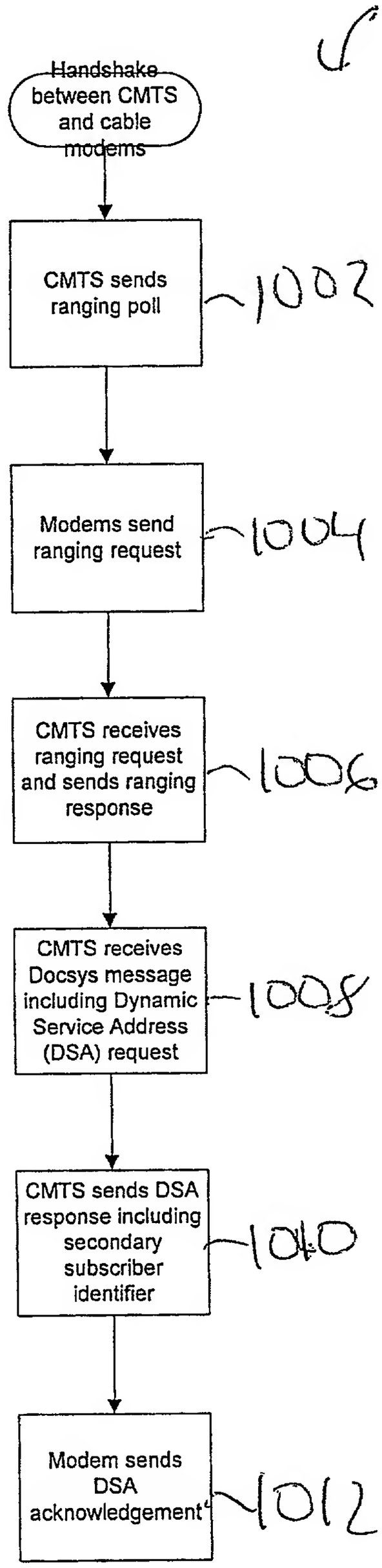
Handshake between CMTS and cable modems
CMTS sends ranging poll
1002
Modems send ranging request
1004
CMTS receives ranging request and sends ranging response
1006
CMTS receives Docsys message including Dynamic Service Address (DSA) request
1008
CMTS sends DSA response including secondary subscriber identifier
1010
Modem sends DSA acknowledgement
1012

FIG. 10

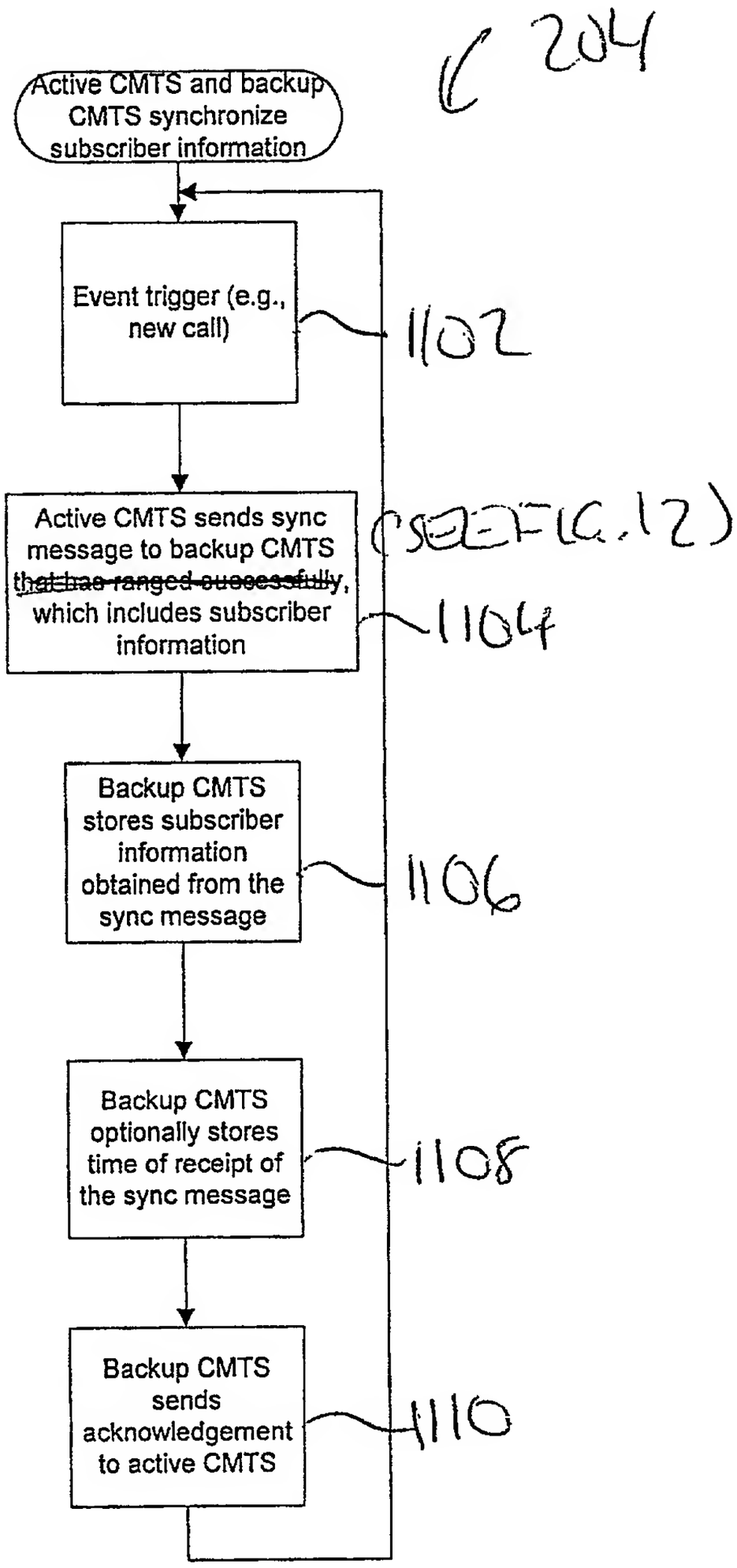
Active CMTS and backup CMTS synchronize subscriber information
Event trigger (e.g., new call)
Active CMTS sends sync message to backup CMTS that has ranged successfully, which includes subscriber information
Backup CMTS stores subscriber information obtained from the sync message
Backup CMTS optionally stores time of receipt of the sync message
Backup CMTS sends acknowledgement to active CMTS
1102
1104
1106
1108
1110
1204
(SEE FIG. 12)

FIG. 11

Sync message 1200

Primary subscriber ID 1202	Secondary subscriber ID 1204
Service template including QOS requirements (e.g., scheduling type) 1206	
Packet classifier 1208	

FIG. 12

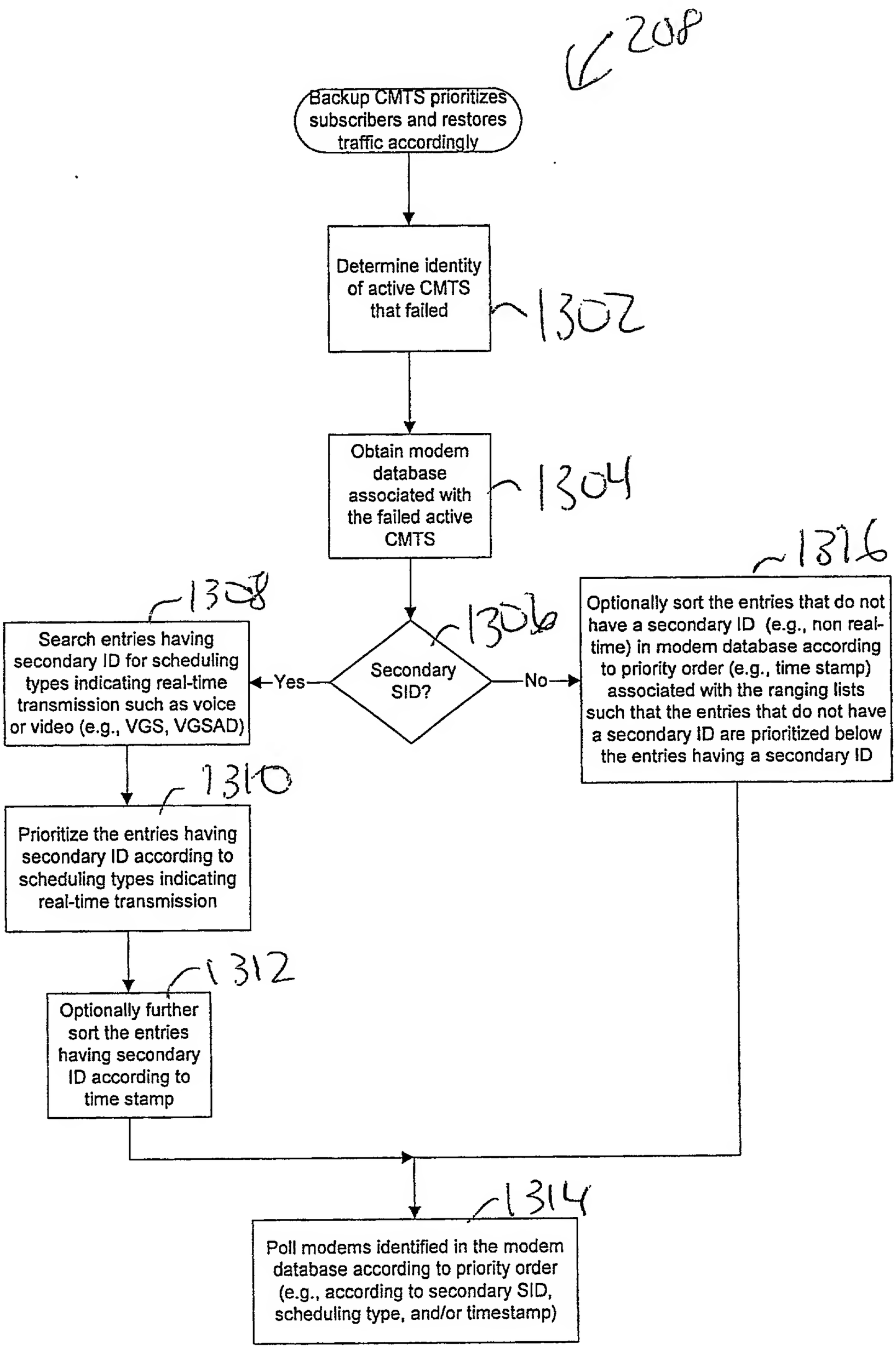
208
Backup CMTS prioritizes subscribers and restores traffic accordingly
Determine identity of active CMTS that failed
1302
Obtain modem database associated with the failed active CMTS
1304
Secondary SID?
1306
Yes
No
Search entries having secondary ID for scheduling types indicating real-time transmission such as voice or video (e.g., VGS, VGSAD)
1308
Prioritize the entries having secondary ID according to scheduling types indicating real-time transmission
1310
Optionally further sort the entries having secondary ID according to time stamp
1312
Optionally sort the entries that do not have a secondary ID (e.g., non real-time) in modem database according to priority order (e.g., time stamp) associated with the ranging lists such that the entries that do not have a secondary ID are prioritized below the entries having a secondary ID
1316
Poll modems identified in the modem database according to priority order (e.g., according to secondary SID, scheduling type, and/or timestamp)
1314

FIG. 13

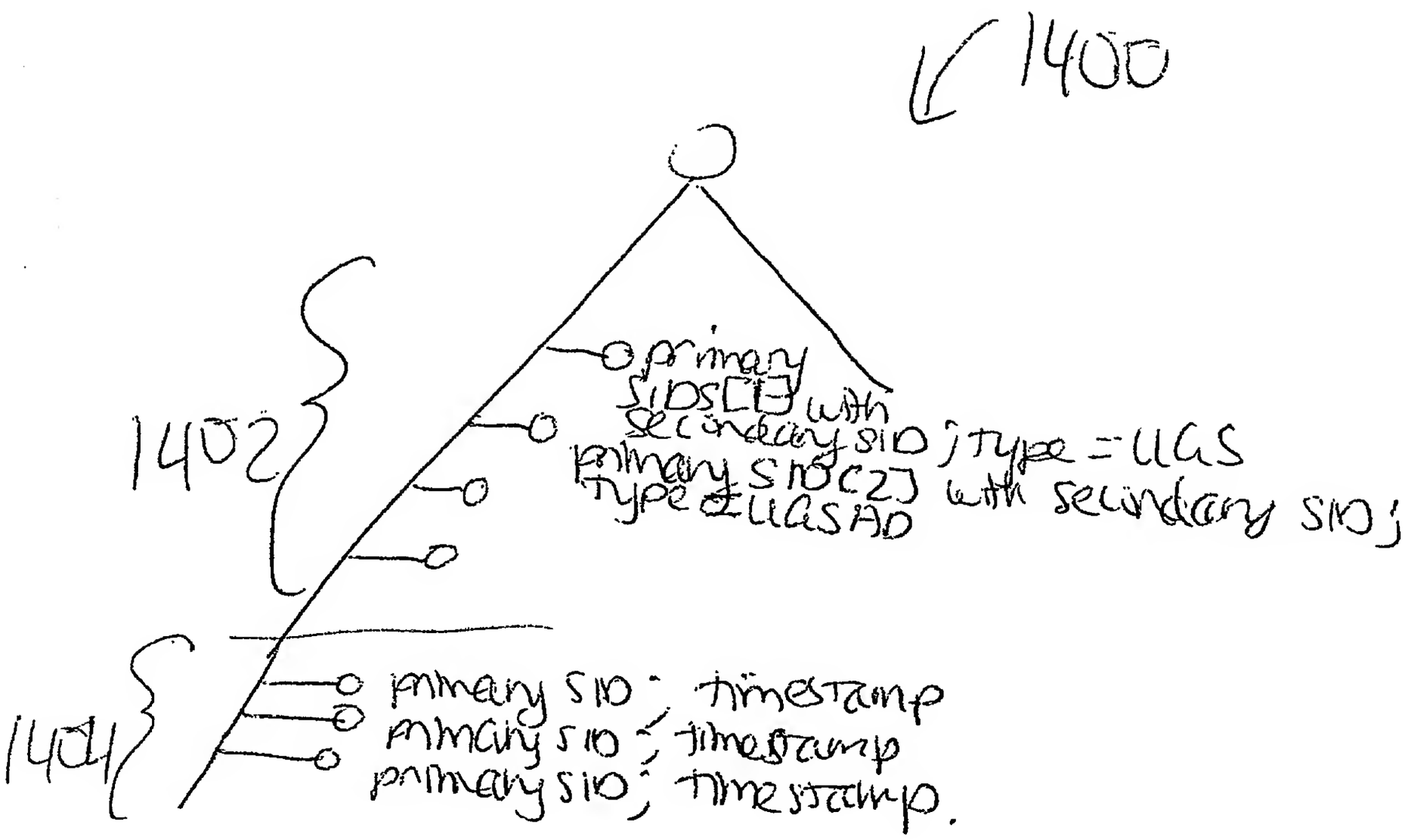
1400
1402
primary SIDS[1] with secondary SID; Type = UAS
primary SID[2] with secondary SID; Type ≠ UASAD
1404
primary SID; timestamp
primary SID; timestamp
primary SID; timestamp.

FIG. 14

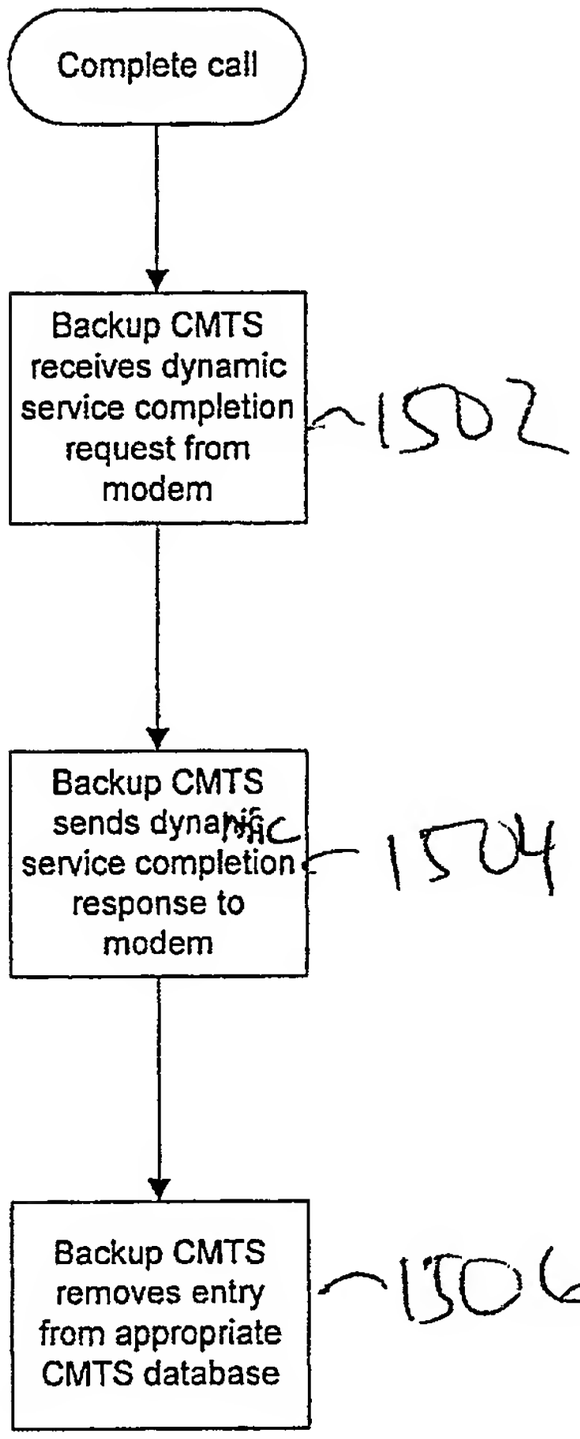
Complete call
Backup CMTS receives dynamic service completion request from modem
1502
Backup CMTS sends dynamic service completion response to modem
1504
Backup CMTS removes entry from appropriate CMTS database
1506

FIG. 15

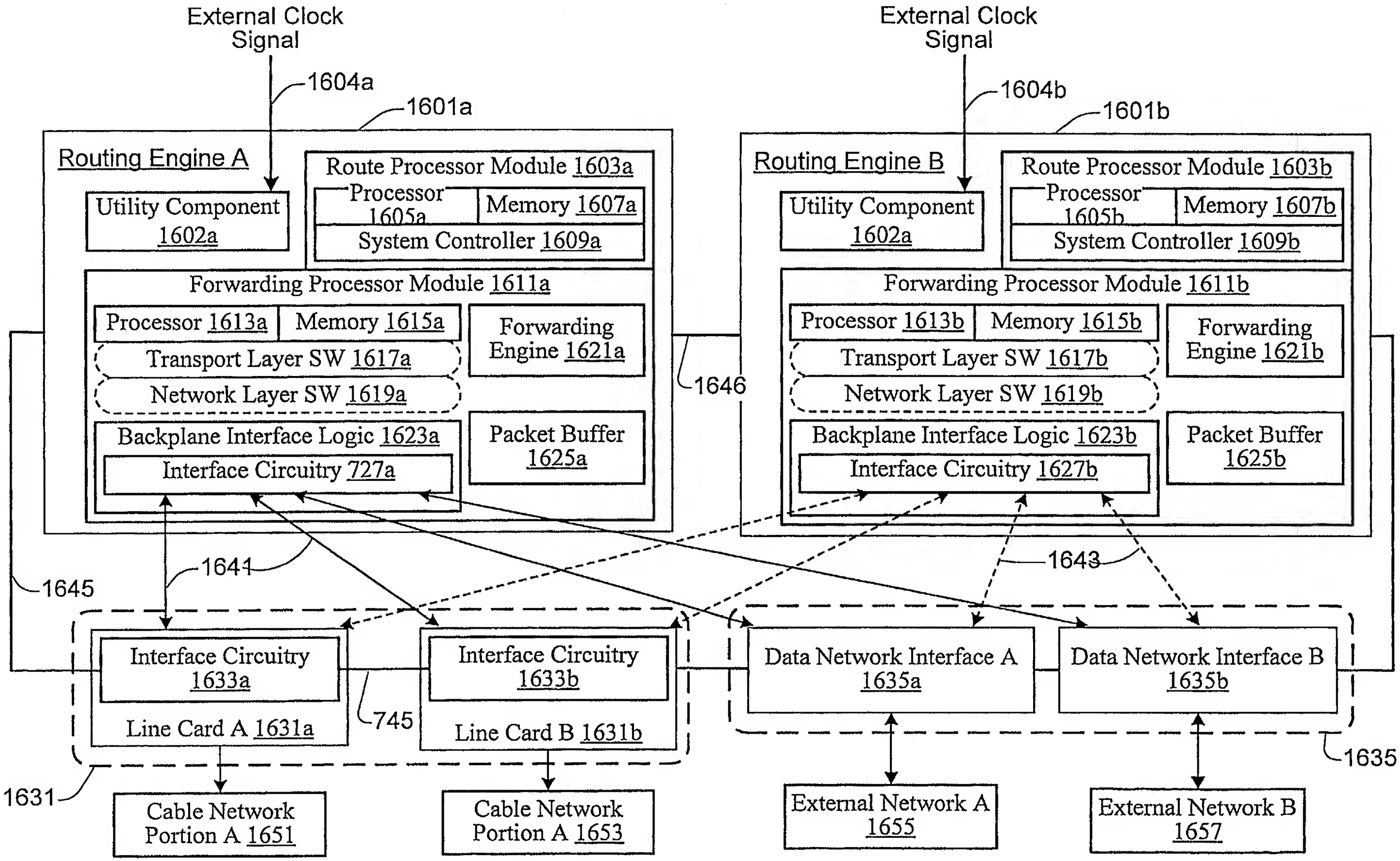

Figure 16 1600

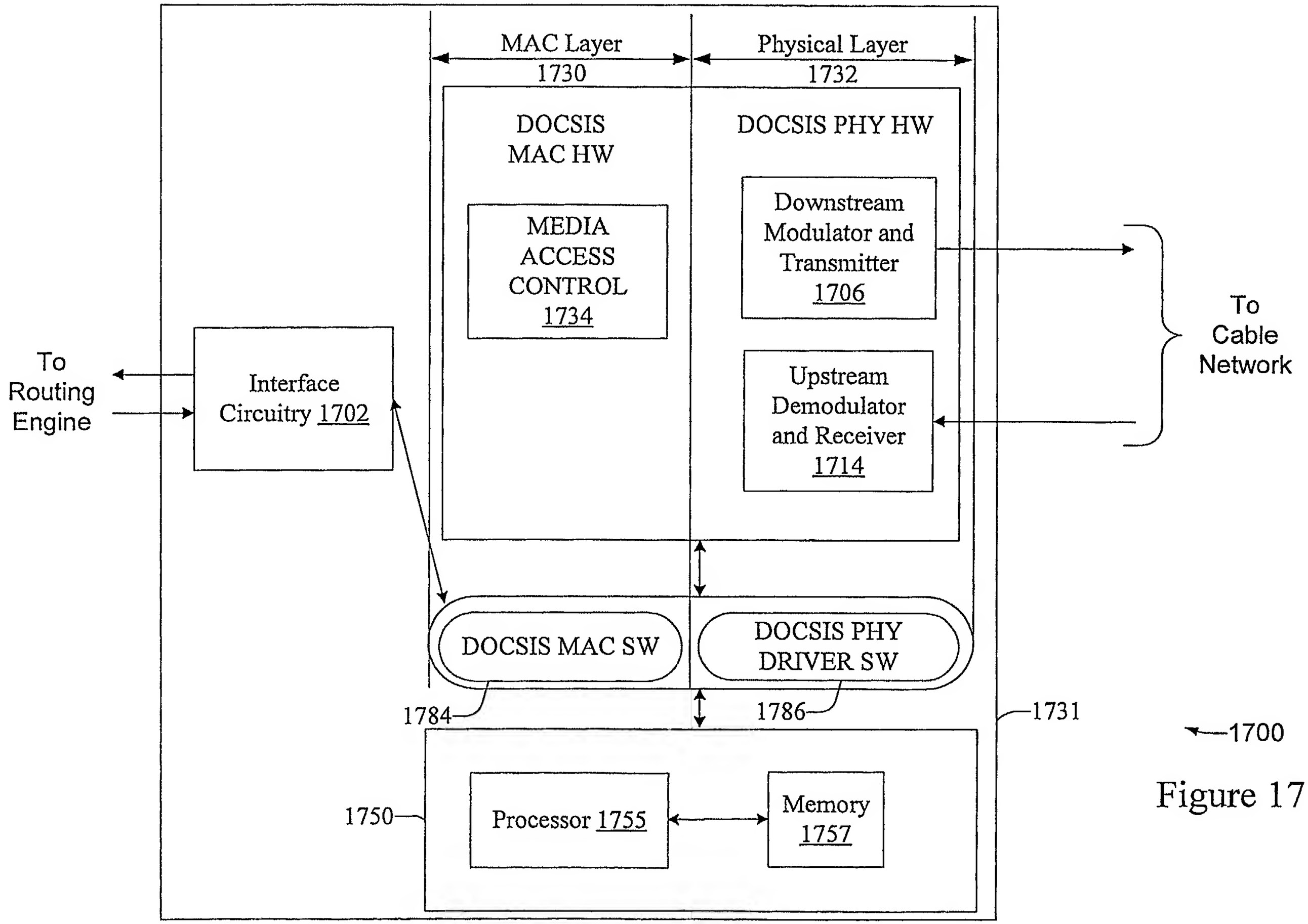
MAC Layer
1730
Physical Layer
1732
DOCSIS
MAC HW
DOCSIS PHY HW
MEDIA
ACCESS
CONTROL
1734
Downstream
Modulator and
Transmitter
1706
To
Routing
Engine
Interface
Circuitry 1702
Upstream
Demodulator
and Receiver
1714
To
Cable
Network
DOCSIS MAC SW
DOCSIS PHY
DRIVER SW
1784
1786
1731
1700
1750
Processor 1755
Memory
1757

Figure 17

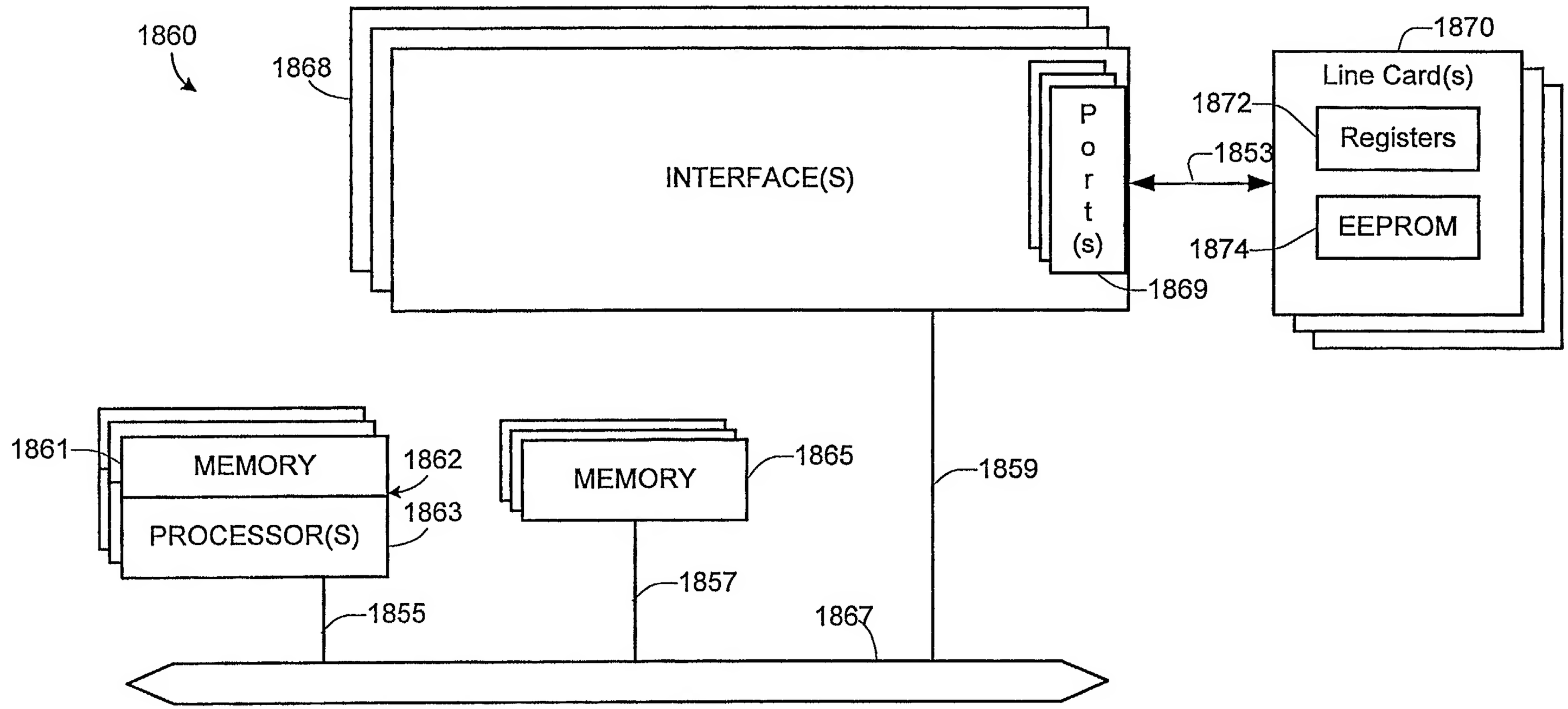
1860
1868
INTERFACE(S)
P
o
r
t
(s)
1869
1870
Line Card(s)
1872
Registers
1853
EEPROM
1874
1861
MEMORY
1862
PROCESSOR(S)
1863
MEMORY
1865
1859
1857
1855
1867

Figure 18